

slowly and uniformly at 530° . It is known that many substances will, when heated, ionise gases. Lime is fairly effective in this respect, thoria to a much greater extent, and radium bromide is the most effective of all. Accordingly, tubes containing the mixture of not very dry hydrogen and nitrous oxide were prepared. One contained a little lime, a second some thoria, and a third some radium bromide. These tubes were heated in an electric resistance furnace side by side with comparative tubes containing the same gases in which was a small quantity of powdered Jena glass to make the conditions as similar as possible. It was found that the rate of combination was much quickened by the presence of lime, much more by the presence of thoria, while the gases in contact with radium bromide, directly the combining temperature was reached, combined with explosion.

When a tube containing thoria and the same mixture was dried for ten days by phosphorus pentoxide, the gases showed no measurable combination when heated for five minutes to 530° .

Hence increasing the ionisation in presence of moisture increases the rate of chemical change, while in absence of moisture it apparently has no effect.

An experiment of rather different type was shown which illustrates the way in which the ionisation of gases may exert its influence. A mixture of sulphur dioxide and sulphuretted hydrogen can be kept unchanged although water vapour is present in some quantity. If, however, liquid water is introduced, separation of sulphur is immediate. A small open tube of radium bromide was placed in such a mixture, and after standing some time the whole of the gases condensed in the small tube of radium bromide in the form of sulphur and water. There is little doubt as to what happens in this case; the water vapour condenses in liquid drops on the ionised particles in the radium tube, and in these drops the reaction between the two gases is completed.¹ In the other chemical changes at high temperatures it is conceivable that condensation to some form approaching the liquid state might take place, in which case Sir J. J. Thomson's theory would apply.

In support of this view must be mentioned some very recent experiments of Prof. J. S. Townsend, which show that a very great diminution in mobility of negative ions is produced when a mere trace of water vapour is added to a dried gas ionised by Röntgen rays. If there is any truth in this provisional working hypothesis, it should be found that ions and water vapour (or some similar substance) must both be present in a mixture of gases if action is to take place. Experiments already in progress seem to show that this is the case, but they have not been sufficiently often repeated for it to be desirable to publish the results at this stage.

The lecture was illustrated by experiments showing the influence of small quantities of moisture on chemical actions.

FUNCTIONS OF A UNIVERSITY.²

I AM often asked, What will the University of Bristol be, and what will it do? The obvious, if not very enlightening answer is, It will, in large measure, be and do that which the citizens of Bristol shall, in their wisdom, determine that it shall be and do. Bristol will have to show the educational stuff of which it is made. It must rise to the great occasion, and prove itself equal to the responsibilities of a city of the first rank.

A university is not primarily a place, or a group of buildings, or a board of examiners. A university is first of all a corporate body of men, and with us of women too, associated together for a definite purpose, and united by a common aim. A university is, or should be, I take it, a guild of learners. Mark you, I do not say a guild of so-called learned folk. I trust there will be learned folk in our guild, and I trust there will be those rarer

¹ Since the phenomenon in gases is admittedly different from that in electrolysis, it is much to be regretted that the same term, ionisation, is retained for both.

² From a speech on the University of Bristol delivered by Prof. C. Lloyd Morgan, F.R.S., at the tenth annual dinner of the University College Colston Society, Bristol, January 14.

folk, men of wisdom and character; but though learned men, and wise men, and men of character, help to make a university, they do not constitute the university which, as a guild of learners, is founded on a broader basis. Nor do the teachers constitute a university, though they too help to make a university of the first rank. The learners constitute the university, and when the teachers cease to be learners they ought also to cease to be teachers. If then the university, as a corporate body, is a guild of learners, and its buildings a temple of learning, all should be welcome in the university who desire to learn, and who have given evidence of adequate breadth of previous education, and the requisite ability to learn at the relatively high level which ought to characterise university work. That is the real and only value of the matriculation test. Each stage of a degree should guarantee not only a higher level of attainment, but also a further ability to learn, and to utilise what has already been learnt.

A university, then, is a guild of learners united together in a corporation in which, as Huxley put it, "thought is free from all fetters, and in which all sources of knowledge, and all aids to learning, should be accessible to all comers without distinction of creed or country, riches or poverty."

The university is not, and cannot be, a place for all; it must be a place for the *selected few*, those only who are capable and willing to do university work. What we have to secure is that there shall be equal opportunities for all, without distinction of riches or poverty. Like the polishing of gems, the higher education is a costly and a lengthy process. It is worth while to spend two years in fashioning a Cullinan diamond, and its value is thus enormously enhanced. To expend this time and labour on mere glass or paste would be a grave economic blunder. In the university we must select the material on which the time and labour of our educational lapidaries is to be bestowed; and it is worth while to take the most anxious care to find your precious stones if only they are true gems. If, say, within the next ten years the University of Bristol can find and fashion but one lad of real genius, who would otherwise be cut off from the highest training, Mr. Wills's investment of 100,000 in the University will be economically justified. That is not merely an opinion of mine. Some of you may remember what Huxley said:—"I weigh my words when I say that if the nation could purchase a potential Watt or Davy, or Faraday at the cost of a hundred thousand pounds down, he would be dirt cheap at the money. It is a mere commonplace and everyday piece of knowledge that what these three men did has produced untold millions of wealth, in the narrowest economical sense of the word." This is a point on which I feel strongly. As a matter of economic policy, from the national standpoint, I am convinced that 100,000 spent by a local education authority on the highest training of the best student will bear far higher interest to the community than the same sum spent in giving a smattering of education to a thousand evening students. Do not, however, misunderstand me. I am not denying that the latter expenditure is of value to the community. All I say is, this ought ye to do, and not to leave the other undone; but I do venture to add that we are not wise in the way in which we manage our national investment in education. As a nation we invest annually between thirteen and fourteen millions in elementary and secondary education in England and Wales. What is the amount of the Treasury grant to university education? About 142,000, a little more than 1 per cent.

The chief thing that should be learnt in a university is how the problems which arise in all serious work are to be approached, to be grappled with, and, if possible, to be solved. That is really the first and foremost thing to be learnt. A leading man of business, whom I met some years ago in the United States, told me that most of the younger men employed in responsible positions in his office held a university degree. I asked wherein lay the practical value of the degree for his purposes. He replied that such men had been trained to face and tackle problems, and he added that it did not much matter in what faculty they had been trained, or, in other words, what line of investigation they had followed during their university career. He contended that the university degree was the

mark of a live man, and what he wanted in his business was live men. That was only one way of expressing the doctrine you have all heard preached. That doctrine concerns the value of research. For, after all, what is meant in this connection by research is just this, that the student is brought face to face with some of the living problems on the growing edge of his subject, and is shown how to deal with them. Such a training is invaluable; but it cannot be adequately tested by a written examination, nor even by a practical examination lasting only a few hours. Hence the importance of giving the teacher who has watched and supervised such work a voice—not, of course, the sole voice, but still an effective voice—in the selection of those on whom a degree is to be conferred. In all the provincial universities the teacher cooperates with the external examiner in gauging the capacity of an undergraduate, and so it will be in Bristol.

It must be remembered that the training of undergraduates, though an important part of the work of a university, is not its only work. A university is not only a place where knowledge is imparted, but where knowledge is made. Apart from the minor researches of undergraduates—which really constitute a training in research—there are the major researches of the staff and of post-graduate students. If the University of Bristol is to take its proper place in the community of provincial universities, the professors and lecturers must have the capacity, and must be given the requisite time, for such research. I will not enlarge upon this subject. I will only direct attention to the fact that there are important agricultural problems and some fishery problems which await solution in the district round us, and to the solution of which I trust the University of Bristol will contribute. The university should be regarded as the natural centre of research in such matters. There must be a great number of commercial problems on which skilled work is required. I should like to see the University specialise on some of these. We shall need, too, some local colour in our University. I cherish the hope that a Cabot chair of geography may be founded in Bristol, where a carefully organised training in this subject, both in its more academic and in its commercial aspect, will be developed.

I have, so far, refrained from making any reference to the system of education which has of late years been developed in Germany. Nor do I now propose to trouble you with statistics and details. On one salient characteristic I venture to comment. Mr. Haldane has directed attention to what he regards as a growing feature of German life, which finds expression in "the double aim of the German university system—pure culture, on the one hand, and on the other the application of the highest knowledge to commercial enterprise." Germany has realised, as England is only beginning to realise, and that somewhat slowly, that the application of the highest knowledge to commercial enterprise is the secret of industrial success. In England the university professor is too often regarded by practical men as an upper schoolmaster, whose doctrinaire notions are of little value outside his class-room or his laboratory; but when some months ago the Chancellor of the Exchequer went into one of the largest workshops of Germany, he was taken round by a professor. He asked what a professor had to do with it, and was told, "the professors are our experts." The Germans, Mr. Lloyd George said, get their ideas from their professors. He regarded the universities as factories where the future of the country is being forged and he gave it as his opinion that there is no investment that will produce such a return, not to the investor, but to generations to come, as the endowment of higher education.

That, then, is one aspect of the function of a university. It should contribute to the work of the world at the highest level of efficiency. Twenty years ago Lord Salisbury said, "Man's first necessity is to live, his first duty is to work, and the object of education is to fit him for his work"; but man does not live by work alone. To achieve success in commercial warfare in the field of industrial competition is not the sole aim of education. This alone will not make a nation great. You will perhaps pardon one who is, in part at least, a philosopher by trade, for quoting Aristotle:—"The whole of life," we read in his "Politics," "is divided into two parts—business and

leisure, war and peace—and all our actions are divided into such as are necessary and useful, and such as are fine. We have to be busy and to go to war, but still more to be at peace and in the enjoyment of leisure. We must do what is useful and necessary, but still more what is fine. These are the aims we have to keep in view in the education of our children, and people of every age that require education." This is the doctrine of culture, a doctrine which, I trust, the University of Bristol will strive to carry out in practice not less sedulously than that of the application of the highest knowledge to commercial enterprise.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

At the monthly meeting of the governors of the Imperial College of Science and Technology on April 2 it was decided, subject to the approval of the King in Council, to recognise the metallurgical department of the University of Sheffield as being in association with the Imperial College of Science and Technology for the advanced metallurgy of iron and steel, as provided for in the charter.

ON April 2, at Edinburgh University, the honorary degree of LL.D. was conferred upon Mr. J. G. Bartholomew, hon. secretary Royal Scottish Geographical Society; Prof. A. Crum Brown, F.R.S.; Prof. W. Burnside, F.R.S., Royal Naval College, Greenwich; Prof. Taylor; Sir Alfred Keogh, K.C.B., Director-General of the Army Medical Service; Prof. C. H. Kronecker, University of Berne; and Dr. J. E. Sandys, Public Orator in Cambridge University.

AMONG recent gifts to higher education in the United States, *Science* announces a donation of 35,400*l.* from Mr. J. D. Rockefeller to the University of Chicago. The New York *Evening Post* states that the University of Missouri will receive 100,000*l.* for the assistance of needy students, by the will of the late Mr. C. R. Gregory, of St. Louis. The Weyerhaeuser interests of St. Paul have given to the University of Minnesota 2200 acres of land in Carlton County for the use of experiments by the forestry department.

A COMMITTEE has been appointed by the Treasury to consider the statements of claims to additional State assistance and estimates of the amounts needed for the respective services, which have been supplied by the Scottish universities at the request of His Majesty's Government; and to report as to what assistance, if any, should be granted from public funds in the interests of the proper development of the work of the universities, due regard being had to the coordination of their work with that of other institutions in Scotland giving instruction of a university standard. The committee is composed of the following members:—the Earl of Elgin and Kincardine, K.C. (chairman), Miss Haldane, Sir Kenelm Digby, G.C.B., Principal Sir Harry Reichel, Mr. C. M. Douglas, Prof. A. R. Forsyth, F.R.S., and Prof. G. Sims Woodhead.

SOMERVILLE COLLEGE, Oxford, is offering, for the third time, a research fellowship of the annual value of 120*l.*, tenable for three years, for which application must be made before May 15 to Miss H. Darbshire, Somerville College, Oxford. The fellowship is now, for the first time, open to women students of Cambridge and Trinity College, Dublin, as well as of Oxford. The two fellows hitherto elected have done valuable original work. Miss E. Jamieson was engaged in researches among the archives in Monte Cassino, La Cava, and Sicily, with a view to the constitutional history of the reign of Roger II. of Sicily. Miss F. Isaac has been engaged in research on the nature and properties of supersaturated crystalline solutions and mixtures, and the results of her work have been published in the *Proceedings of the Royal and other scientific societies*.

THE Board of Education has published a volume which contains particulars of the application of funds by local authorities in England and Wales to the purpose of education, other than elementary, in the financial year ended March 31, 1907. The returns deal with secondary edu-